

IN THE CLAIMS:

1. (Currently Amended) A plasma processing method comprising the steps of:

placing a substrate inside a reaction chamber of a plasma processing system, a silicon dioxide oxide film and a resist pattern having been formed in order on the surface of the substrate;

introducing an etching gas composed of a fluorocarbon gas into the reaction chamber, ~~wherein the fluorocarbon gas is composed of at least one of C₄F₆, C₅F₈, and C₆F₆ gases~~ the fluorocarbon gas includes carbon and fluorine, and C/F is 0.5 or more; and

creating a plasma from the etching gas and etching the silicon dioxide oxide film with the plasma and using the resist pattern as a mask,

wherein a residence time τ of the fluorocarbon gas in the reaction chamber is controlled at a value greater than 0.1 sec and equal to or less than 1 sec, so that the selectivity of the etching rate of the silicon oxide film with respect to the etching rate of the resist pattern is 2 or more, the residence time τ being given by $P \times V/Q$, where P is a pressure (unit: Pa) of the fluorocarbon gas, V is a volume (unit: L) of the reaction chamber and Q is a flow rate (unit: Pa · L/sec) of the fluorocarbon gas.

2. (Cancelled)

3. (Original) The plasma processing method of Claim 1, wherein the residence time τ is controlled by a mass flow controller provided for the plasma processing system and/or a valve and a pump provided for the plasma processing system.

4. (Currently amended) A plasma processing method comprising the steps of:

placing a substrate inside a reaction chamber of a plasma processing system, a silicon dioxide oxide film having been formed on the surface of the substrate;

introducing an etching gas composed of a fluorocarbon gas into the reaction chamber, ~~wherein the fluorocarbon gas is composed of at least one of C₄F₆, C₅F₈, and~~

C_6F_6 -gases includes carbon and fluorine, and C/F is 0.5 or more; and

creating a plasma from the etching gas and etching the silicon dioxide oxide film with the plasma and using the resist pattern as a mask,

wherein a parameter E = $P \times W_0/Q$ (P is a pressure (unit: Pa) of the fluorocarbon gas, W_0 is a flow rate (unit: Pa • L/sec) of the fluorocarbon gas) is controlled at a value greater than $0.8 \times [10^4]$ 10^4 sec • W/m³ and equal to or less than 8×10^4 sec • W/m³, $P \times W/Q$ being a product of a residence time τ of the fluorocarbon gas in the reaction chamber and a power density P_i of power applied to create the plasma, the residence time τ being given by $P \times V/Q$, where P is a pressure (unit: Pa) of the fluorocarbon gas, V is a volume (unit: L) of the reaction chamber and Q is a flow rate (unit: Pa • L/sec) of the fluorocarbon gas, the power density P_i being given by W_0/V , where W_0 is a magnitude (unit: W) of the power and V is the volume (unit: L) of the reaction chamber so that the selectivity of the etching rate of the silicon oxide film with respect to the etching rate of the resist pattern is 2 or more, without considering the volume of the reaction chamber in the plasma processing system.

5. (Cancelled)

6. (Currently Amended) The plasma processing method of Claim 4, wherein the [[residence time τ]] parameter E is controlled by a mass flow controller provided for the plasma processing system and/or a valve and a pump provided for the plasma processing system.

Claims 7-8 (Cancelled).

9. (Currently amended) The plasma processing method of Claim [[13]] 19, wherein the [[residence time τ]] parameter E is controlled by a mass flow controller provided for the plasma processing system and/or a valve and a pump provided for the plasma processing system.

10. (Currently amended) A plasma processing method comprising the steps

of:

placing a substrate inside a reaction chamber of a plasma processing system;
introducing a fluorocarbon gas into the reaction chamber, wherein the fluorocarbon gas is composed of at least one of C_4F_8 , C_5F_8 and C_6F_8 gases includes carbon and fluorine, and C/F is 0.5 or more; and

creating a plasma from the fluorocarbon gas and depositing an organic film on the substrate using the plasma,

wherein a parameter $E = P \times W_0/Q$ (P is a pressure (unit: Pa) of the fluorocarbon gas, W^0 is a magnitude (unit: W) of the power applied to create the plasma and Q is a flow rate (unit: Pa \cdot L/sec) of the fluorocarbon gas) is controlled at 0.8×10^4 sec \cdot W/m³ or less, $P \times W_0/Q$ being a product of a residence time τ of the fluorocarbon gas and a power density P_i of power applied to create the plasma, the residence time τ being given by $P \times V/Q$, where P is a pressure (unit: Pa) of the fluorocarbon gas, V is a volume (unit: L) of the reaction chamber and Q is a flow rate (unit: Pa \cdot L/sec) of the fluorocarbon gas, the power density P_i being given by W_0/V , where W_0 is a magnitude (unit: W) of the power and V is the volume (unit: L) of the reaction chamber without considering the volume of the reaction chamber in the plasma processing system.

11. (Cancelled).

12. (Original) The plasma processing method of Claim 10, wherein the residence time τ is controlled by a mass flow controller provided for the plasma processing system and/or a valve and a pump provided for the plasma processing system.

Claims 13-18 (Cancelled).

[[13]] 19. (Currently Amended) A plasma processing method comprising the steps of:

placing a substrate inside a reaction chamber of a plasma processing system, a silicon dioxide oxide film having been formed on the surface of the substrate;

introducing a first fluorocarbon gas into the reaction chamber, wherein the first

fluorocarbon gas is composed of at least one of C_4F_6 , C_5F_8 , and C_6F_6 gases includes carbon and fluorine, and C/F is 0.5 or more;

creating a first plasma from the first fluorocarbon gas and etching the silicon dioxide oxide film with the first plasma;

introducing a second fluorocarbon gas into the reaction chamber, wherein the second fluorocarbon gas is composed of at least one of C_4F_6 , C_5F_8 , and C_6F_6 gases includes carbon and fluorine, and C/F is 0.5 or more; and

creating a second plasma from the second fluorocarbon gas and depositing an organic film on the silicon dioxide oxide film with the second plasma,

wherein a residence time τ of the first fluorocarbon gas in the reaction chamber is controlled at a value greater than 0.1 sec and equal to or less than 1 sec, the residence time τ being given $P \times V/Q$, where P is a pressure (unit: Pa) of the first fluorocarbon gas, V is a volume (unit: L) of the reaction chamber and Q is a flow rate (unit: $Pa \cdot L/sec$) of the first fluorocarbon gas; and

wherein a residence time τ of the second fluorocarbon gas in the reaction chamber is controlled at a value equal to or less than 0.1 sec, the residence time τ being given by $P \times V/Q$.